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Civil Engineering

ELECTRICAL SAFE PRACTICES

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This instruction implements Air Force policy directive (AFPD) 32-10, *Installations and Facilities*. It assigns responsibilities to personnel who maintain and operate electrical systems and facilities. Headquarters, Air Force Civil Engineer Support Agency, Engineering Support Directorate (HQ AFCESA/CES) is the final interpretation authority for definitions and guidance contained in this document. Engineering Technical Letter (ETL) 04-15, *Electrical Safety Guidance,* and ETL 06-9, *Arc Flash Personal Protective Equipment (PPE) Requirements of High Voltage Overhead Line Work at 69 kV (nominal) or Less,* provides additional safety requirements. Users should send comments and suggested improvements on AF Form 847, **Recommendation for Change of Publication**, through major commands (MAJCOM) to HQ AFCESA/CES, 139 Barnes Dr, Suite 1, Tyndall AFB, FL 32403-5319. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with AFPD 37-1, *Air Force Information Management*, and Air Force manual (AFMAN) 37-123, *Management of Records*, and disposed of in accordance with the Air Force Records Disposition Schedule (RDS) located at **https://afrims.amc.af.mil**.

SUMMARY OF CHANGES

This interim update to AFI 32-1064 clarifies safe clearance manager responsibilities, supervisor responsibilities for determining safe practices and appropriate PPE, and high-voltage underground/overhead distribution and transmission line work procedures. A bar (|) indicates a revision from the previous edition.

1. Application and Scope. This instruction assigns supervisor responsibilities and provides necessary guidance to safely build, operate, and maintain electrical distribution systems and equipment. It complies with AFI 91-301, *The Air Force Occupational and Environmental Safety, Fire Protection, and Health Program (AFOSH)*, and incorporates National Consensus Standards. Other requirements for worker safety are in ETL 04-15, *Electrical Safety Guidance*.

2. Supervisor Responsibilities.

2.1. Personal Safety. The most important part of a supervisor's job is to get the job done **safely**. Supervisors must provide a safe and healthful work environment. Facilities, work areas, equipment, and work procedures must comply with safety, fire, and health policies. Each supervisor must be thoroughly familiar with safe working practices, particularly those in ETL 04-15 and applicable standards and codes referenced in **Attachment 1**.

2.2. Planning and Worker Awareness. Plan the work properly and ensure it is performed safely. Review job requirements with the workers and ensure they understand why and how to do the work, the hazards they may encounter and how to control them, and the proper procedures for working safely.

2.3. Training Assistance. Provide general and specific safety instructions and training to workers. Give personnel the opportunity to attend formal technical schools for training. Make sure each employee has access to this instruction and ETL 04-15 and demonstrates satisfactory knowledge before performing any task. Document all training on AF Form 55, **Employee Safety and Health Record.**

2.3.1. After initial job safety training, train employees annually on lock out/tag out, safe clearance, confined spaces entry, manhole, pole top and bucket truck rescue and shop operating instructions.

2.3.2. Train employees weekly on abnormal or hazardous existing conditions (e.g., switches left in an abnormal condition or bypassed, broken equipment temporarily fixed, changes to the one-line distribution map or schematic diagram, lock out or safe clearance tags left on unfinished jobs).

2.4. Safety Meetings. Make safety briefings interesting and successful by using a variety of aids such as safety posters, mock-ups (using the actual equipment where appropriate), pictures, and films. Be enthusiastic. As a minimum, cover the following topics:

2.4.1. Lockout/tagout.

2.4.2. Selected safety rules (two or three).

2.4.3. Methods and hazards of jobs in progress.

2.4.4. Unsafe practices and common causes of mishaps.

2.4.5. Recent accidents.

2.4.6. Potential personal injuries.

2.4.7. Personal protective equipment (PPE).

2.4.8. Electrical tools.

2.4.9. Materials handling.

2.4.10. Good housekeeping.

2.4.11. Adequate illumination.

2.4.12. Working on or near machinery.

2.4.13. Ladders.

2.4.14. Working in elevated positions.

2.4.15. Lifting and hoisting equipment, including aerial lifts.

2.4.16. Grounding systems.

2.4.17. Working in underground facilities (confined spaces).

2.4.18. Overhead lines.

2.4.19. First aid.

2.4.20. Rescue and resuscitation.

2.5. Specific Job-Related Safety Training.

2.5.1. Give special attention to hazardous conditions workers may encounter on any new task.

2.5.2. Instruct employees who must handle poisons, caustics, and other harmful substances in their safe handling and potential hazards. Include required personal hygiene and protective measures. See paragraph **3.** on polychlorinated biphenyls (PCB).

2.5.3. Instruct employees who work on job sites where harmful plants or animals are present regarding potential hazards, how to avoid injury, and relevant first aid.

2.5.4. Instruct employees who must enter confined or enclosed spaces on hazards and necessary precautions. Specific instructions and procedures to enter and work in hazardous or potentially hazardous confined spaces must comply with the requirements in AFOSH standard (AFOSHSTD) 91-25, *Confined Spaces*. Technical orders or other procedures that incorporate the requirements established in the standard are valid and may be used. This training should also include egress even if the space is not confined.

2.5.5. The employee should describe the work assignment and methods.

2.6. Assigning Tasks. Assign employees to jobs they are capable of doing safely. Permit only qualified personnel to operate equipment and machinery. Ensure two qualified employees work together when high-voltage circuits or energized circuits are present.

2.7. Job Site Inspection. Frequently inspect job sites, materials, and equipment and ensure unsafe items are tagged, rendered inoperative, or removed from the work site. Ensure safe working conditions and practices. Take action to correct any observed or reported violation of safety rules in this instruction. Pay particular attention to safe clearance procedures and practices when working on energized lines and equipment. Present safety briefings to workers at the job site. See paragraphs **4.** and **5.**

2.8. Work Injuries. Report injuries, even minor ones, to the employee's immediate supervisor as directed in AFI 91-202, *The US Air Force Mishap Prevention Program*.

2.9. Mishap Reports. Investigate every mishap involving an injury, property damage, or “near misses.” Determine the cause and implement corrective action to prevent recurrence. Notify the wing or installation safety staff of all mishaps involving injuries or property damage. Investigate and report certain mishaps through safety channels according to AFI 91-204, *Safety Investigation and Reports.* Either the supervisor or base safety personnel will perform the investigation.

2.10. Standards and Codes. Train employees to comply with AFOSH standards and the following codes: National Fire Protection Agency (NFPA) 70, *National Electrical Code (NEC)*; NFPA 70E,

Standard for Electrical Safety in the Workplace; National Electrical Safety Code (NESC or ANSI C2); state, local, and host nation codes (see **Attachment 1**).

2.11. **Protective Equipment.** Equip workers properly and train them to use and maintain tools and PPE properly. Pay particular attention to rubber insulating protective equipment (rubber gloves, sleeves, line hoses, hoods, and covers) and hotline tools. Make sure equipment receives periodic electrical tests in accordance with applicable American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) specifications (see **Attachment 1**).

2.12. Scheduling Routine Maintenance. Schedule routine maintenance when disrupting power will cause the least inconvenience to all users. Arrange electrical circuits and equipment of the prime power source to important facilities to allow efficient performance of routine maintenance tasks with minimum outages.

2.13. First Aid Training. Ensure all electrical personnel (military and civilian) receive training in CPR, controlling bleeding, shock management, emergency care of a person having open wounds or burns, and using automated external defibrillators.

2.13.1. Host base medical personnel usually train unit CPR instructors. If the host base cannot provide medical personnel, they can arrange for certification of unit personnel through the American Red Cross or American Heart Association.

2.13.2. Personnel shall be re-certified annually. Written documentation of recertification is required.

2.13.3. Relevant emergency phone numbers shall be readily available to all personnel.

2.14. Rescue Training. Train individuals designated by the supervisor for rescuing workers from confined spaces according to Occupational Safety and Health Administration (OSHA) and AFOSH requirements; this includes initial and annual refresher training.

2.15. Noise Hazards. Ensure all potentially hazardous noise sources are identified to bioenvironmental engineering services for evaluation. Ensure all personnel that may be exposed to noise hazards are made aware of them and use the controls required by AFOSHSTD 161-20, *Hearing Conservation Program.* To warn workers, post noise hazard warning signs at noise hazard area entry points.

2.16. System Maintenance. Maintain electrical systems properly so they will continue to operate in a safe and effective manner (AFI 32-1063, *Electric Power Systems*). Do not authorize or permit alterations or modifications to equipment or protective device settings without adequate engineering guidance and study. This shall include removing all obstacles and vegetation that restrict unimpeded egress from the work area or ready access to equipment.

2.17. Technical Data. Make sure current maintenance and operations procedures, diagrams, schematics, device settings, fuse sizes, and manuals are available and properly used. Develop them if manufacturers' data are not available; obtain engineering guidance if necessary.

2.18. Supervisory Control and Data Acquisition (SCADA) Systems. All operators of SCADA systems that remotely control electrical distribution systems must have full knowledge of the base distribution system and thorough understanding of switching procedures. Operators must keep each display screen (schematic or map) within the SCADA system up-to-date and all switching points on the remote terminal unit accurately identified. Develop local procedures for remote operation of circuit breakers and switches to ensure safety of personnel and equipment.

2.19. Safe Clearance. Make sure all workers are thoroughly familiar with and comply with safe clearance procedures found in NFPA 70E, AFOSH Standard 91-25, or those posted at the job location before starting work. See paragraph **4.** Do not permit work unless workers follow these procedures.

2.20. Work on Energized Equipment. Work on energized electrical equipment is prohibited except in circumstances when justified to and approved by the Base Civil Engineer (BCE) or equivalent in accordance with paragraph **5.** Before de-energizing circuits or equipment for routine maintenance or repair, the BCE shall:

2.20.1. Provide a minimum three-day notice to all users who may be affected by the electrical utility outage. Facility manager approval is not required, but as a courtesy an effort should be made to coordinate the outage. Coordinate substation, switch station, or major feeder outages with the utility provider, giving as much advance notification as possible.

2.20.2. Assist users with authorized backup power, either through equipment authorization inventory data or real property installed equipment generators; prepare to run a backup generator during the outage if necessary.

3. Polychlorinated Biphenyls (PCB).

3.1. Purpose and Limitations. PCB is a class of nonflammable liquid insulation formerly used as a transformer liquid dielectric. PCB is a suspected carcinogen and no longer manufactured. Several manufacturers distributed PCB under various trade names such as Askarel, Inerteen, Pyranol, Chlorextol, and others.

3.2. Personal Contact Precautions. Workers should avoid contact with PCBs. If PCB contacts the skin, remove it with waterless hand cleaner, wipe with towels, and dispose of towels with other contaminated material. Flush eye thoroughly with water if eye contact occurs and seek further medical attention.

3.3. Cleaning Spills. Clean up PCB spills immediately. Prevent PCB from reaching storm drains, sewers, drainage ditches, or any other place where water is flowing. Handle a PCB spill and report it according to base and Environmental Protection Agency (EPA) requirements. Report a spill through the base environmental coordinator.

3.4. Controlling Equipment Containing PCB. Mark, handle, store, dispose of, and account for equipment containing PCB according to the latest EPA standards. Contact the base environmental coordinator for additional information and the latest EPA rulings.

4. Safe Clearance Requirement. Require safe clearance procedures for personnel opening and closing switches while working on transmission or distribution lines and equipment. Safe clearance procedures are necessary to clear lines and equipment for work in the **deenergized** condition. Safe clearance will include locking out switches, breakers, or other controlling devices when necessary. Mishap prevention tags, completing and posting energized work permits, and grounding provide additional warning and safety if lockout is not possible because of equipment design; however, if a circuit cannot be locked out, a qualified worker must remain at the controlling device while work is being conducted. No individual may work on lines or equipment until all safety requirements are met.

4.1. Safe Clearance Responsibilities.

4.1.1. The safe clearance manager, who is designated by the BCE, will issue a written safe clearance as required. The safe clearance manager will arrange for interruption of service, must have knowledge of the base distribution system, and notify the utility company supplying power to the installation before performing any operation that may affect the utility company's system.

An on-site supervisor may also perform the duty of Safe Clearance Manager or Switching Supervisor, (person receiving safe clearance), but never both. The Safe Clearance Manager and person receiving the safe clearance (Switching Supervisor) must never be one and the same.

4.1.2. Develop local procedures for proper switching, blocking, tagging, and lockout when switching by remote control, such as the SCADA system. Depending on the type of SCADA system, each software manufacturer will have different protocols to identify and issue tag orders for equipment or switchgear being worked on. Each worker and system operator must fully understand local procedures; local procedures must be accessible or available in the work area. Physically verify all SCADA-issued commands for opening and lockout before beginning work. When working on equipment with local control capability, the technician should take control from the SCADA operator and notify the operator when the equipment is returned to normal operation. The operator must issue blocking orders and attach messages stating the reason for the condition and estimated restoration time.

4.2. **Switching and Blocking Procedures.** The Switching Supervisor (person receiving AF Form 269 from the Safe Clearance Manager) ensures workers accomplish switching, blocking, and tagging operations in the sequence specified on AF Form 269, **Electrical Facilities Safe Clearance**. When work is completed, operations shall begin only when authorized by the Safe Clearance Manager and will be performed in the reverse order. For instance, if a detail of switching, blocking, and tagging reads, "Open Switch No. 501 and Attach Danger Tag," the opposite operation is "Remove Danger Tag and Close Switch No. 501." Annotate the form with the date and time. Do not operate switches bearing AF Form 979, **Danger Tag**, or AF Form 982, **Danger Tag: Do Not Start**, under any circumstances without specific authorization from the operations flight chief. Notify the SCADA systems operator before operating remotely operated or monitored circuit-opening devices. The "local-remote" switch must be blocked in the position which disables remote operation. Notify the operator when work is complete and remote operation is safe.

4.3. Tagging Procedures. “Tagging” is placing an appropriate tag directly on the circuit opening device. Apply tags and lock out the energy control device to ensure safety and prevent unauthorized personnel from altering device positions. Before beginning work on a line or equipment, place danger tags in a conspicuous place upon opening a switch, disconnects, cutouts, primary jumpers, or breakers.

4.4. Underground Distribution Systems. Block the switch mechanically and lock and tag the handle on underground distribution systems when it is not practical to provide a visible line break. Always use AF Form 979; AF Form 980, **Caution Tag**; and AF Form 982 under a safe clearance (AF Form 269), except when working on secondary lines or equipment. Do not use AF Form 269 when applying AF Forms 979, 980, and 982 on secondary lines or equipment.

4.5. Grounding Lines and Equipment. Before touching for work, always check all deenergized transmission and distribution lines and equipment, test for voltage, and ground. Treat all lines not grounded as energized. For definitions of transmission and distribution voltages, see **Attachment 1**.

5. Energized Circuits. When energized work is deemed absolutely necessary, it should be accomplished with extreme caution and only when the basic energized work procedures listed in the following paragraphs are followed and reviewed with all personnel immediately before starting. Furthermore, if any potential environmental, safety and health, operational, fiscal or mission risks are associated with working on energized circuits, the base/wing Staff Judge Advocate shall be notified and consulted. Such risks may also create potential legal liabilities for the Air Force and Air Force personnel.

5.1. **Electrical Work Less than 600 Volts (V) and Not In Manholes.** Work on or near energized electrical equipment less than 600 V is prohibited except in rare circumstances and then only when approved by the BCE or equivalent. Authorization is not required for tasks such as voltage measurement on circuits operating less than 600 V, as long as maintenance or repair is not performed and safe practices and appropriate PPE are used. Safe practices and appropriate PPE are determined by the qualified site supervisor who shall follow applicable AFOSH, HQ AFCESA ETL, UFC, and NFPA 70E, Article 130 guidance.

5.1.1. The BCE must approve energized work in advance.

5.1.2. Use two-person teams to perform work.

5.1.3. A qualified supervisor must be consulted and must approve any plan to work on energized equipment and ensure proper use of PPE.

5.1.4. The energized work permit must be prepared in advance and as a minimum include:

5.1.4.1. Description of work and location.

5.1.4.2. Description of work practices to be followed.

5.1.4.3. An electrical shock analysis and boundaries (safe working distance).

5.1.4.4. Arc flash hazard analysis and flash boundary determination.

5.1.4.5. Necessary PPE to safely perform the task, i.e., arc flash, shock, or other required PPE.

5.1.4.6. Means to restrict access by unqualified persons in work area.

5.1.4.7. An emergency egress plan in the event of an emergency.

5.1.4.8. Evidence of completing the job briefing, i.e., safety, tools, PPE, any other hazards.

5.1.5. Place special emphasis on PPE and appropriate supervision. Proper supervision, training, and planning are paramount to ensure safety.

5.1.6. Conventional circuit de-energizing/re-energizing methods (i.e., turning off/on a switch, opening and closing switches, or operating circuit breakers/disconnects) for the purpose of isolating circuits is considered performing "energized work" and all the procedures of paragraph **5.** above shall be followed; however, for the purposes of this paragraph, BCE approval is granted through a written safe clearance form in accordance with paragraph **4.**

5.2. **Overhead/Underground Line Work Greater Than 600 V, But Less Than 34.5 Kilovolts (kV).** Work on or near energized distribution lines is prohibited except in rare circumstances and then only when approved by the BCE or equivalent in accordance with procedures outlined in the following paragraphs. Authorization is not required for tasks such as voltage measurement, as long as maintenance or repair is not performed and safe practices and appropriate PPE are used. Safe practices and

appropriate PPE are determined by the qualified site supervisor who shall follow applicable AFOSH, HQ AFCESA ETL, UFC, and NFPA 70E, Article 130 guidance.

5.2.1. The BCE must approve energized work in advance based upon an acceptable operational risk management (ORM) analysis prepared by the operations flight chief in accordance with AFI 90-901, *Operational Risk Management*, and AFPAM 90-902**,** *Operational Risk Management (ORM) Guidelines And Tools*.

5.2.2. Use two-person teams to perform work.

5.2.3. A qualified supervisor must be consulted and approve any plan to work on energized equipment and ensure proper use of PPE.

5.2.4. The energized work permit must be prepared in advance and as a minimum include:

5.2.4.1. Description of work and location.

5.2.4.2. Description of work practices to be followed.

5.2.4.3. An electrical shock analysis and boundaries (safe working distance).

5.2.4.4. Arc flash hazard analysis and flash boundary determination.

5.2.4.5. Necessary PPE to safely perform the task, i.e., arc flash, shock, or other required PPE in accordance with NFPA 70E and, if applicable for overhead line work, ETL 06-9, Arc *Flash Personal Protective Equipment (PPE) Requirements for High Voltage Overhead Line Work at 69 kV (nominal) or Less*.

5.2.4.6. Means to restrict access by unqualified persons in the work area.

5.2.4.7. An emergency egress plan in the event of an emergency.

5.2.4.8. Evidence of completing the job briefing, i.e., safety, tools, PPE, any other hazards.

5.2.4.9. The ORM analysis shall be kept with the energized work permit and retained for a period of one year following completion of the work.

5.2.5. Place special emphasis on PPE and appropriate supervision. Proper supervision and planning are paramount to ensure safety.

5.2.6. Conventional circuit de-energizing/re-energizing methods (i.e., turning off/on a switch, opening and closing switches, or operating circuit breakers/disconnects) for the purpose of isolating circuits is considered performing "energized work" and all the procedures of paragraph **5.** shall be followed; however, for the purposes of this paragraph, BCE approval is granted through a written safe clearance form in accordance with paragraph **4.**

5.2.7. Supervision. While the job is in progress, an on-site supervisor must closely supervise the workers, checking them constantly to make sure they are in safe working positions, handling tools safely, and complying with the energized work permit.

5.3. **Overhead/Underground Line Work between 34.5 kV and 69 kV.** Work on or near energized distribution/transmission lines greater than 34.5 kV is prohibited except in rare circumstances and only when justified through a documented ORM analysis approved by the BCE or equivalent in accordance with procedures outlined in the following paragraphs.

5.3.1. The BCE must approve energized work in advance based upon an acceptable ORM analysis prepared by the operations flight chief in accordance with AFI 90-901 and AFPAM 90-902.

5.3.2. Use two-person teams to perform work.

5.3.3. A qualified supervisor must be consulted and must approve any plan to work on energized equipment and ensure proper use of PPE.

5.3.4. The energized work permit must be prepared in advance and as a minimum include:

5.3.4.1. Description of work and location.

5.3.4.2. Description of work practices to be followed.

5.3.4.3. An electrical shock analysis and boundaries (safe working distance).

5.3.4.4. Arc flash hazard analysis and flash boundary determination.

5.3.4.5. Necessary PPE to safely perform the task, i.e., arc flash, shock, or other required PPE in accordance with NFPA 70E and, if applicable for overhead line work, ETL 06-9, *Arc Flash Personal Protective Equipment (PPE) Requirements for High Voltage Overhead Line Work at 69 kV (nominal) or Less*.

5.3.4.6. Means to restrict access of unqualified persons in work area.

5.3.4.7. An emergency egress plan in the event of an emergency.

5.3.4.8. Evidence of completing the job briefing, i.e., safety, tools, PPE, any other hazards.

5.3.4.9. The ORM analysis shall be retained with the energized work permit for a period of one year following completion of the work.

5.3.5. Place special emphasis on PPE and appropriate supervision. Proper supervision and planning are paramount to ensure safety.

5.3.6. Conventional circuit de-energizing/re-energizing methods (i.e., turning off/on a switch, opening and closing switches, or operating circuit breakers/disconnects) for the purpose of isolating circuits is considered performing "energized work" and all the procedures of paragraph **5.** shall be followed; however, for the purposes of this paragraph, BCE approval is granted through a written safe clearance form in accordance with paragraph **4.**

5.3.7. Supervision. While the job is in progress, an on-site supervisor must closely supervise the workers, checking them constantly to make sure they are in safe working positions, handling tools safely, and complying with the energized work permit.

5.4. **Electrical Work in Manholes.** Work on or near energized electrical equipment in manholes is extremely dangerous and prohibited except when justified to and approved by the BCE or equivalent in accordance with the following paragraphs. All manhole electrical circuits shall be completely de-energized before starting any troubleshooting, maintenance or repair action within the manhole, unless justified to and approved by the BCE or equivalent in accordance with the following paragraphs. Entering a manhole for the purpose of examining insulated cable, equipment, or accomplishing other inspections not requiring touching or disturbing the energized conductors or equipment is permitted, but requires wear of minimum Hazard/Risk Category 2 arc flash PPE (NFPA 70E) and compliance with other confined space requirements (AFOSHSTD 91-25).

5.4.1. The BCE must approve energized work in advance, and:

5.4.1.1. Prepare an ORM analysis detailing the rationale and energized work procedures to be followed while working in the manhole (information copy to the MAJCOM electrical engineer; Air Force Safety Center, Engineering and Standards Branch [HQ AFSC/SEGS]; and Air Force Civil Engineer Support Agency, Mechanical/Electrical Engineering Division [HQ AFCESA/CESM]). Follow guidance in AFI 90-901 and AFPAM 90-902.

5.4.1.2. Absolutely no work shall be accomplished on energized circuits in standing water.

5.4.1.3. Bases shall retain the electrical manhole ORM analysis with the energized work permit for a period of one year following completion of the work.

5.4.2. Use three-person teams to perform work (two people in the manhole and one aboveground spotter).

5.4.3. A qualified supervisor must be consulted and approve any plan to work on energized equipment and ensure proper use of PPE.

5.4.4. The energized work permit must be prepared in advance and as a minimum include:

5.4.4.1. Description of work and location.

5.4.4.2. Description of work practices to be followed.

5.4.4.3. Electrical shock analysis and boundaries (safe working distance).

5.4.4.4. Arc flash hazard analysis and flash boundary determination.

5.4.4.5. Necessary PPE to safely perform the task, i.e., arc flash, shock, or other required PPE.

5.4.4.6. Options and means to restrict access by unqualified persons in the work area.

5.4.4.7. Option and means to rescue incapacitated workers.

5.4.4.8. Description of compliance action and/or methods with AFOSHSTD 91-25.

5.4.4.9. Evidence of completing the job briefing, i.e., safety, tools, PPE, any other hazards, and ORM assessment.

5.4.5. Place special emphasis on PPE and appropriate supervision. Proper supervision and planning are paramount to ensure safety.

5.4.6. Conventional circuit de-energizing/re-energizing methods (i.e., turning off/on a switch, opening and closing switches, or operating circuit breakers/disconnects) for the purpose of isolating circuits is considered performing "energized work" and all the procedures of paragraph **5.** shall be followed; however, for the purposes of this paragraph, BCE approval is granted through a written safe clearance form in accordance with paragraph **4.**

6. Form Prescribed. Safe clearance procedures require the use of AF Form 269, **Electrical Facilities Safe Clearance**.

7. Forms Adopted: AF Form 55, **Employee Safety and Health Record**; AF Form 979, **Danger Tag**; AF Form 980, **Caution Tag**; and AF Form 982, **Danger Tag: Do Not Start**.

DONALD J. WETEKAM, Lt General, USAF
DCS/Logistics, Installations & Mission Support

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFPD 32-10, *Installations and Facilities*

AFPD 33-1, *Information Management*

AFI 32-1063, *Electric Power Systems*

AFI 90-901, *Operational Risk Management*

AFI 91-202, *The US Air Force Mishap Prevention Program*

AFI 91-204, *Safety Investigation and Reports*

AFI 91-301, *The Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program*

AFMAN 37-123, *Management of Records*

AFPAM 90-902, *Operational Risk Management (ORM) Guidelines And Tools*

AFOSH Standard 48-8, *Controlling Exposures to Hazardous Materials*

AFOSH Standard 91-10, *Civil Engineering*

AFOSH Standard 91-25, *Confined Spaces*

AFOSH Standard 91-50, *Communications Cable, Antenna and Communications–Electronic (C-E) Systems*

AFOSH Standard 91-501, *Air Force Consolidated Occupational Safety Standard*

AFOSH Standard 161-20, *Hearing Conservation Program*

ETL 04-15, *Electrical Safety Guidance*

DELETED ETL 06-1, *Arc Flash Personal Protective Equipment (PPE) Requirements for High Voltage Overhead Line Work at 69 kV (nominal) or Less*

ETL 06-9, *Arc Flash Personal Protective Equipment (PPE) Requirements for High Voltage Overhead Line Work at 69 kV (nominal) or Less*

ANSI C2, *National Electrical Safety Code*

ANSI/ASTM D120, *Standard Specification for Rubber Insulating Gloves*

ANSI/ASTM D178, *Standard Specification for Rubber Insulating Switchboard Matting*

ANSI/ASTM D1048, *Standard Specification for Rubber Insulating Blankets*

ANSI/ASTM D1049, *Standard Specification for Rubber Insulating Insulator Covers*

ANSI/ASTM D1050, *Standard Specification for Rubber Insulating Line Hose*

ANSI/ASTM D1051, *Standard Specification for Rubber Insulating Sleeves*

ANSI/ASTM F478, *Standard Specification for Inservice Care of Insulating Line Hose and Covers*

ANSI/ASTM F496, *Standard Specification for Inservice Care of Insulating Gloves and Sleeves*

NFPA 70, *National Electric Code*

NFPA 70E, *Standard for Electrical Safety in the Workplace*

Abbreviations and Acronyms

AFMAN—Air Force manual

AFOSH—Air Force Occupational Safety and Health

AFOSHSTD—Air Force Occupational Safety and Health Standard

AFPD—Air Force policy directive

ANSI—American National Standards Institute

BCE—base civil engineer

EPA—Environmental Protection Agency

ETL—Engineering Technical Letter

kV—kilovolt

MAJCOM—major command

NFPA—National Fire Protection Agency

ORM—operational risk management

OSHA—Occupational Safety and Health Administration

PCB—polychlorinated biphenyls

PPE—personal protective equipment

SCADA—Supervisory Control and Data Acquisition

UFC—Unified Facilities Criteria

V—volt

Terms

Approved—Sanctioned, endorsed, accredited, certified, or accepted as satisfactory by a duly constituted and nationally recognized authority or agency.

Authorized Person—A person approved or assigned by a supervisor to perform a specific duty or duties or to be at a specific location or locations at the job site.

Blocking—Placing a switch in the open or closed position and mechanically ensuring the position of the switch cannot be accidentally changed.

Cable—A conductor with insulation or a stranded conductor with or without insulation and other coverings (single conductor cable or a combination of conductors) insulated from one another (multiple conductor cable). ***NOTE:*** A cable sheath may consist of multiple layers of which one or more are conductive.

Cardiopulmonary Resuscitation (CPR)—An emergency medical procedure that includes opening and maintaining an airway, providing ventilation through rescue breathing, and providing artificial circulation through the use of external cardiac compression.

Certified or Certification—The accomplishment of curriculum as specified in this instruction.

Circuit—For purposes of this instruction, a conductor or system of conductors through which an electric current is intended to flow.

Circuit Breaker—A device to open and close a circuit and to open the circuit automatically at a predetermined overload of current, without injury to itself, when properly applied within its rating.

Conductor—Material (typically a wire, cable, or bus bar) for carrying an electric current. ***NOTE:*** This term is used only in reference to current-carrying parts that are sometimes alive (energized).

Energized—Electrically connected to or having a source of voltage.

Equipment—General term which includes fittings, devices, appliances, fixtures, apparatus, and like items used as part of, or in connection with, an electrical power transmission and distribution system, or communication systems.

- *Equipment - Climbing.* Includes body belts, safety and climber straps, climbers and ladders.

- *Equipment - Electrical Inspecting and Testing*. Electrical and mechanical devices such as voltmeters, ammeters, ohmmeters, phase meters, and similar devices.

- *Mobile and Portable - Large Equipment*. Relatively large equipment items easily transported for maintenance, including line trucks, aerial lift trucks, motor-generator sets, pole hole diggers, and similar apparatus.

- *Equipment - Protective*. Includes rubber gloves, line hose, matting, blankets, insulator hoods, and sleeves, in addition to barricades and warning devices.

Limited Approach Boundary—An approach limit at a distance from an exposed live part within which a shock hazard exists.

Live (Energized) (parts)—Energized conductive components. Electrically connected to a source of potential difference or electrically charged to have a potential significantly difference from the earth in the vicinity. The term "live" is sometimes used in place of the term "current carrying" where the intent is clear to avoid repetition of the longer term.

Live Line (Hotline) Work—Maintenance of energized high voltage electrical conductors or equipment using approved hotline tools and rubber protective goods.

Mishap—An unplanned or unsought event or series of events that results in death, injury, or occupational illness or damage to or loss of equipment or property.

Qualified—One who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved.

Supervisor—Refers to the supervisor of "employees or workers" as used in this instruction. Generally includes the supervisor responsible for exterior electrical systems, the zone supervisor or foreman, and the infrastructure support element supervisor. Titles are necessary to assign specific responsibilities to a specific individual.

Switch—A device for opening and closing or changing the connection of a circuit. In this instruction, the term is generic for all oil circuit breakers, air switches, network protectors, disconnects (either fusible or plain), hot clamps, and other devices which open an electrical circuit.

Tag—A system or method of identifying circuits, systems, or equipment being worked on.

Tagging—Placing a safety tag directly on a circuit opening device or equipment for additional safety to ensure it is not used or its position altered.

Tags—Temporary signs (usually attached to a piece of equipment or part of a structure) to warn of existing or immediate danger.

Voltage—The effective root mean square (RMS) potential difference between any two conductors or between a conductor and ground. Voltages are usually listed as nominal values. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class to provide a convenient nomenclature. The operating voltage of the system may vary above or below this value.

– *Secondary Voltage.* Lines and equipment operating at and below 600 V (nominal phase-to-phase).

– *Distribution Voltage.* Lines and equipment operating above 600 V (nominal phase-to-phase) up to and including 36 kV (nominal phase-to-phase).

– *Transmission Voltage.* Lines and equipment operating above 36 kV (nominal phase-to-phase).

– *Low Voltage.* Lines and equipment operating at and below 600 V (nominal phase-to-phase).

– *High Voltage.* Lines and equipment operating above 600 V (nominal phase-to-phase).

Working Near (live parts)—Any activity inside a *Limited Approach Boundary*.

Working On (live parts)—Coming in contact with live parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the PPE a person is wearing.